CLAIMS

What is claimed is:

1. An organic electronic device comprising an emitting layer wherein at least 20% by weight of the emitting layer comprises at least one compound having a formula below:

$$IrL^aL^bL^c{}_xL'_yL''_z,$$

where:

x = 0 or 1, y = 0, 1 or 2, and z = 0 or 1, with the proviso that:

x = 0 or y + z = 0 and

when y = 2 then z = 0;

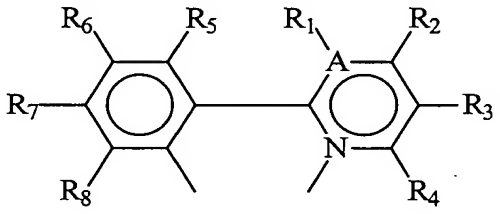
L' = a bidentate ligand or a monodentate ligand, and is not a phenylpyridine, phenylpyrimidine, or phenylquinoline; with the proviso that:

when L' is a monodentate ligand, y+z = 2, and

when L' is a bidentate ligand, z = 0;

L" = a monodentate ligand, and is not a phenylpyridine, and phenylpyrimidine, or phenylquinoline; and

L^a, L^b and L^c are alike or different from each other and each of L^a, L^b and L^c has structure (I) below:



(I)

wherein:

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring,

at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and

A = C or N, provided that when A = N, there is no R_1.

2. The device of Claim 1 wherein x = 1, y = 0, and z = 0.

3. The device of Claim 2 wherein A = C and none of R_1-R_8 is selected from nitro.

4. The device of Claim 1 wherein R_3 is CF_3.

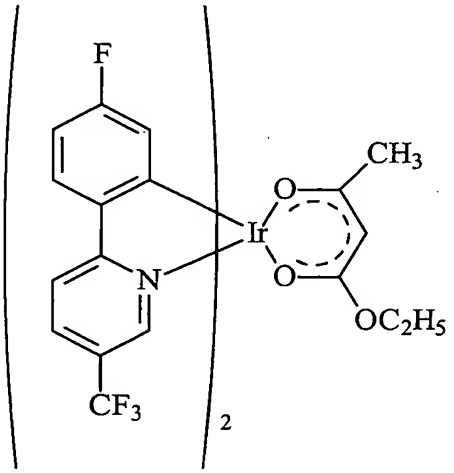
5. The device of Claim 4 wherein at least one of R_5-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br.

6. The device of Claim 2 wherein A = C, $R_3 = CF_3$, R_7 = F, and R_1, R_2, R_4-R_6 and R_8 = H.

7. The device of Claim 2 wherein A = C, R_3 and $R_6 = CF_3$, and R_1, R_2, R_4, R_5, R_7 and R_8 = H.

8. The device of Claim 2 wherein A = C, $R_3 = CF_3$, R_6 and R_8 = F, and R_1, R_2, R_4, R_5, and R_7 = H.

9. The device of Claim 1 wherein x = 0 and y = 1 having a structure (VI) below:



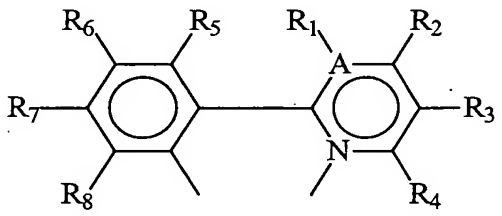
(VI)

10. An organic electronic device comprising an emitting layer wherein the emitting layer comprises a diluent and less than 20% by weight of at least one compound that has a formula below:

$$IrL^aL^bL^c,$$

where:

L^a, L^b and L^c are alike or different from each other and each of L^a, L^b and L^c has structure (I) below:



(I)

wherein:

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring,

at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and

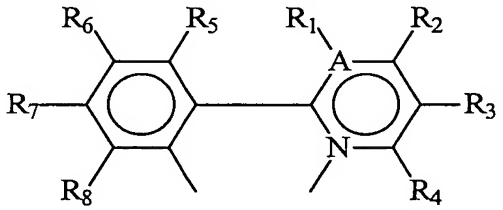
A = C or N, provided that when A = N, there is no R_1.

11. The device of Claim 10 wherein the diluent is selected from poly(N-vinyl carbazole), polysilane, 4,4'-N,N'-dicarbazole biphenyl, and tertiary aromatic amines.

12. The device of Claim 1, further comprising a hole transport layer selected from N,N'-diphenyl-N,N'-bis(3-methylphenyl)-[1,1'-biphenyl]-4,4'-diamine (TPD), 1,1-bis[(di-4-tolylamino) phenyl]cyclohexane (TAPC), N,N'-bis(4-methylphenyl)-N,N'-bis(4-ethylphenyl)-[1,1'-(3,3'-dimethyl)biphenyl]-4,4'-diamine (ETPD), tetrakis-(3-methylphenyl)-N,N,N',N'-2,5-phenylenediamine (PDA), α-phenyl-4-N,N-diphenylaminostyrene (TPS), p-(diethylamino)-benzaldehyde diphenylhydrazone (DEH), triphenylamine (TPA), bis[4-(N,N-diethylamino)-2-methylphenyl](4-methylphenyl)methane (MPMP), 1-phenyl-3-[p-(diethylamino)styryl]-5-[p-(diethylamino)phenyl] pyrazoline (PPR or DEASP), 1,2-trans-bis(9H-carbazol-9-yl)cyclobutane (DCZB), N,N,N',N'-tetrakis(4-methylphenyl)-(1,1'-biphenyl)-4,4'-diamine (TTB), porphyrinic compounds, and combinations thereof.

13. The device of Claim 1, further comprising an electron transport layer selected from tris(8-hydroxyquinolato)aluminum, 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (DDPA), 4,7-diphenyl-1,10-phenanthroline (DPA), 2-(4-biphenylyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (PBD), 3-(4-biphenylyl)-4-phenyl-5-(4-t-butylphenyl)-1,2,4-triazole (TAZ), and combinations thereof.

14. A compound having a formula selected from *fac*-Ir(L)$_3$, *mer*-Ir(L)$_3$, and combinations thereof, where L is selected from group 1-a through 1-m and 1-q through 1-v, as shown in Table 1, and has structure (I) below:



(I)

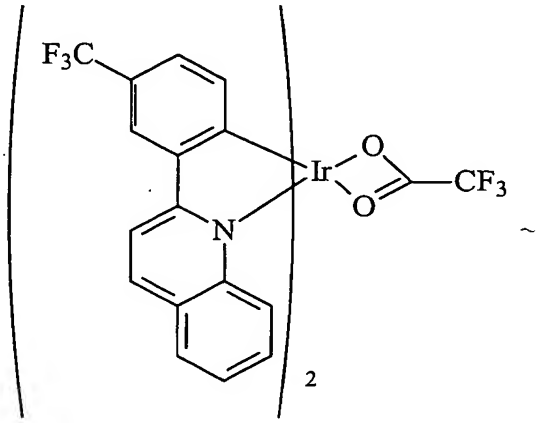
wherein:

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring,

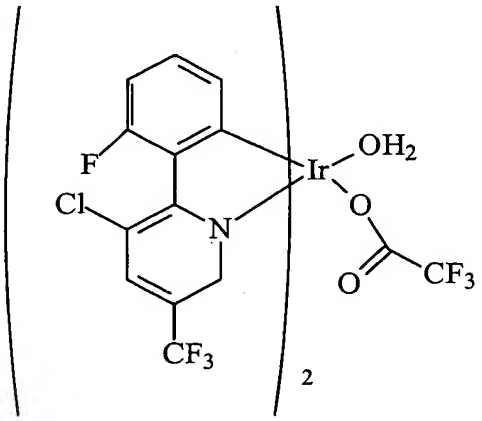
at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and

A = C or N, provided that when A = N, there is no R_1.

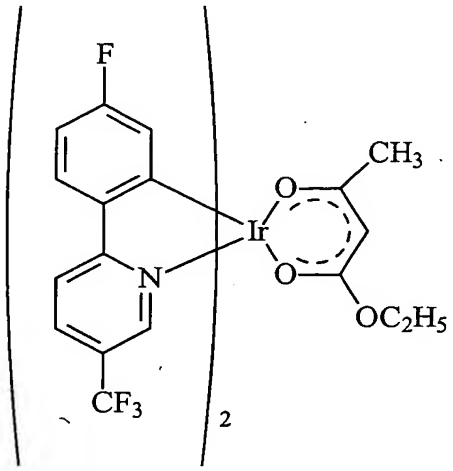
15. A compound having a structure selected from structures (IV), (V), (VI), (IX) and (X) below:



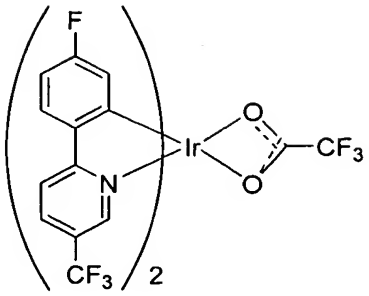
(IV)



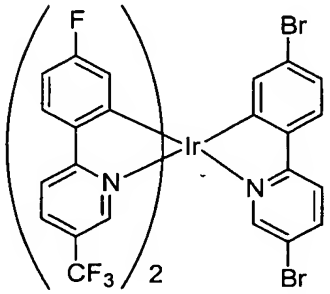
(V)



(VI)



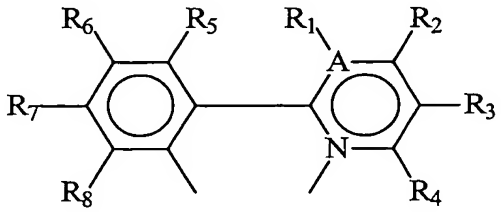
(IX)



(X)

16. An organic electronic device comprising an emitting layer that comprises a compound selected from the following (i) and (ii):

(i) a compound having a formula selected from *fac*-Ir(L)$_3$, *mer*-Ir(L)$_3$, and combinations thereof, where L is a group selected from 1-a through 1-m and 1-q through 1-v, as shown in Table 1 and has structure (I) below:



(I)

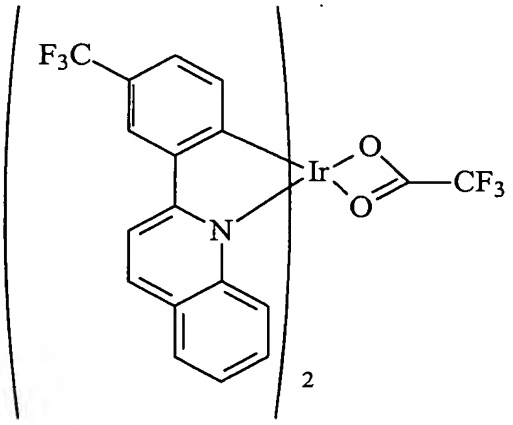
wherein:

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring,

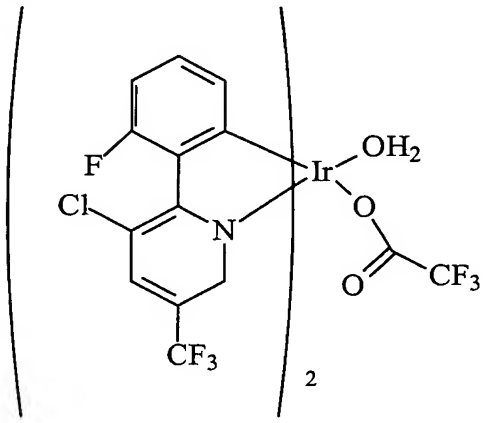
at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and

A = C or N, provided that when A = N, there is no R_1;

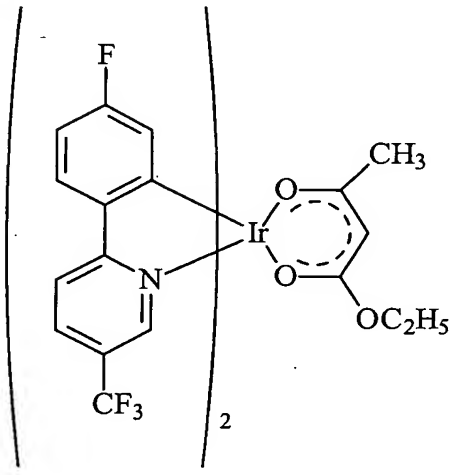
(ii) a compound having one of structures (IV), (V), (VI), (IX), and (X) below:



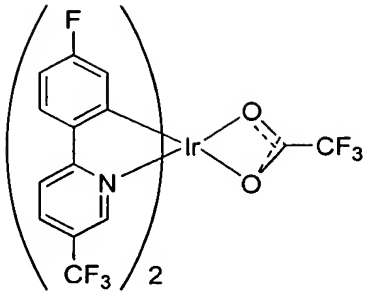
(IV)



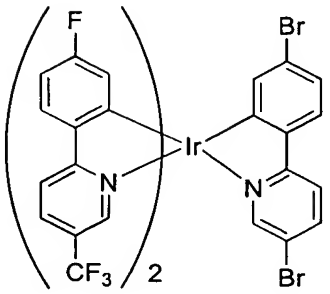
(V)



(VI)



(IX)

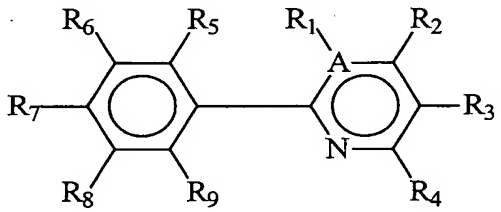


(X)

17. The device of Claim 16 wherein the emitting layer further comprises a diluent.

18. The device of Claim 17 wherein the diluent is selected from poly(N-vinyl carbazole), polysilane, 4,4'-N,N'-dicarbazole biphenyl, and tertiary aromatic amines.

19. A compound selected from compounds 2-a through 2-aa as shown in Table 2, having structure (II) below:



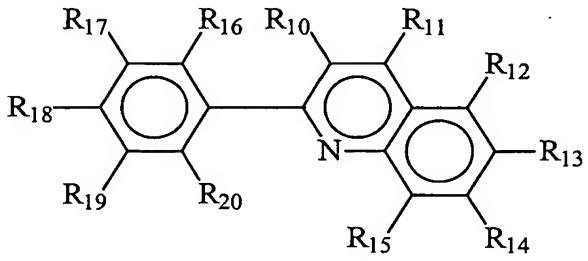
(II)

wherein: R_9 is H;

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring;

at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and A = C or N, provided that when A = N, there is no R_1.

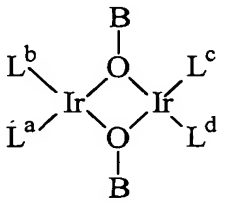
20. A compound having structure (III) below:



(III)

wherein $R_{17} = CF_3$ and R_{10}-R_{16} and R_{18}-R_{20} = H.

21. A compound having structure VII below:

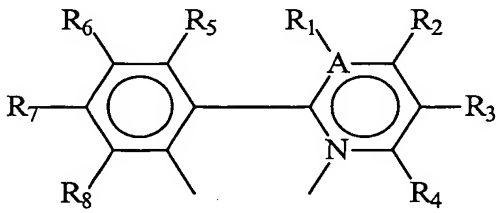


(VII)

wherein:

B = H, CH_3, or C_2H_5;

L^a, L^b, L^c, and L^d are the same or different from each other; and each of L^a, L^b, L^c, and L^d has structure (I) below:



(I)

wherein:

adjacent pairs of R_1-R_4 and R_5-R_8 can be joined to form a five- or six-membered ring,

at least one of R_1-R_8 is selected from F, C_nF_{2n+1}, OC_nF_{2n+1}, and OCF_2X, where n = 1-6 and X = H, Cl, or Br, and A = C or N, provided that when A = N, there is no R_1.

22. The compound of Claim 21 wherein:

$L^a = L^b = L^c = L^d$;

B = H;

$R_3 = CF_3$;

$R_7 = F$;

R_1, R_2, R_4-R_6 and R_8 = H.